Medical imaging technology detects vascular disorders, injuries in brain without invasive contrast agents

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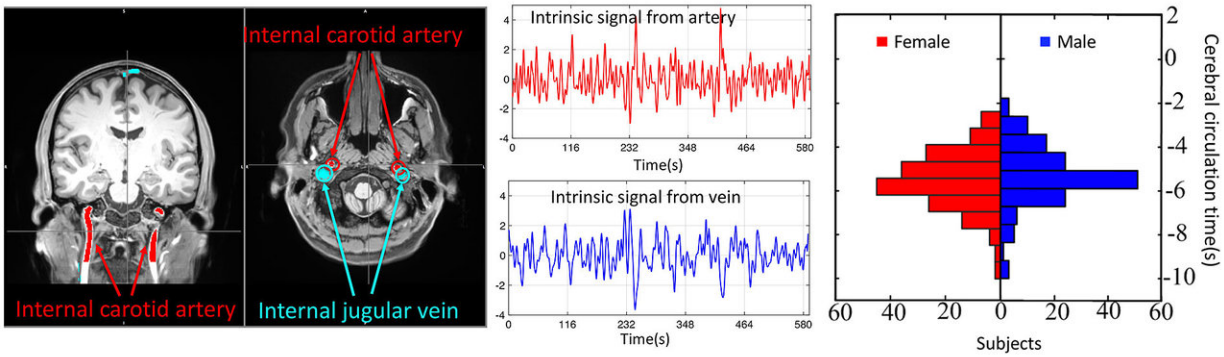

This graphic shows the procedure of identifying and extracting intrinsic signals from big arteries and veins in an fMRI scan, and using them to calculate the cerebral circulation time of young healthy males and females. Credit: Purdue University

Purdue University researchers have developed an analytical imaging technology based on functional MRI for detecting and monitoring cerebral vascular disorders and injuries that does not require the use of contrast agents.

The new imaging method focuses on tracking an intrinsic blood-related MRI signal, which has been shown to travel with the blood. The signal is

used as a natural biomarker to assess blood flow in a patient.

"We can compare the signal from symmetric arteries and veins in both hemispheres or neck to assess the cerebrovascular integrity, or the balance of blood flow," said Yunjie Tong, an assistant professor in Purdue's Weldon School of Biomedical Engineering, who developed the technology along with Blaise Frederick, a biophysicist and associate professor at Harvard Medical School. "The blood flow should be symmetric between the two sides in a healthy subject."

The time delay between the intrinsic signals from the internal carotid artery and the internal jugular vein represents the cerebral circulation time. A prolonged time delay also indicates blood flow disturbance in the brain, possibly caused by a tumor, traumatic brain injury or other brain disorders or diseases.

Traditional imaging methods, including MRIs, calculate the cerebral circulation time using contrast agents, which are injected into the patient. The measurement can only be made for a few seconds after the injection, but the new method will allow a continuous monitoring of the circulation time.

"The new method can even be applied on some existing MRI data to calculate the cerebral circulation time," Tong said. "This method is safer and non-invasive since we don't inject contrast agents, which can stick to vessels or cause other health problems."

Tong worked with both Purdue Engineering MRI facility and Purdue Life Science MRI Facility to develop and test the technology, which is compatible with current MRI scanners and other imaging devices, such as near infrared spectroscopy. He would like to do further testing to see how the new imaging method might be beneficial to football players who suffer head injuries.

The work has been supported by grants from the National Institutes of Health. A report on this study was published in the *Journal of Cerebral Blood Flow and Metabolism*. Tong is now looking for companies, medical institutions and other collaborators to complete additional testing on the imaging method.

Provided by Purdue University

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